Can the Market Breakthrough in AAL be Achieved by a Large Scale Pilot?

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Abstract Ambient Assisted Living is still on the cusp of a mainstream breakthrough, even though the market potential is tremendous. As barriers to the success of AAL, (Wichert et al. in How to overcome the market entrance barrier and achieve the market breakthrough in AAL. Ambient Assisted Living. Springer, Berlin, 2012) mentions the lack of viable business models as well as the lack of ecosystems around common open platforms. Considering the fact that the EU has supported the development of universAAL as a true candidate for such common open platforms, this paper describes the next logical step towards the rollout of AAL throughout Europe based on this platform so that the foundation stone for the emergence of a self-organizing ecosystem is laid. In order to elaborate the feasibility of such rollouts, the European Commission published in early 2012 a CIP-ICT-PSP call for piloting AAL in large-scale based on interoperable platforms, where the winner was the proposal "make it ReAAL" that builds on universAAL as the common open platform. In addition to the applications coming with the universAAL Platform, the local vendors from each pilot region will offer their AAL products and services to the participating pilot sites. This means that a two-way adaptation is supposed to be addressed in ReAAL: on one hand, the universAAL native applications can be adapted to the requirements of the pilot sites, and on the other hand, the existing applications from the pilot regions can be integrated with the universAAL platform. Each Pilot site will then be able to select from this portfolio, those applications that are more suitable for their planned intervention. The mission of ReAAL is in this context to find out if the adaptation of a product to a common platform is economically reasonable when a company plans to enter the market with a new product idea. Based on this, ReAAL will

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hopefully show the cost-effectiveness of interoperable solutions compared to both vertical isolated solutions and comprehensive but closed systems. This should pave the way for the emergence of an ecosystem around a common open platform and based on that for the market breakthrough of AAL through interoperability.

Keywords Market potential of Ambient Assisted Living · Business model · AAL reference platform · Standardization · Market breakthrough · Large scale pilot

1 A Long Way to a Common Approach

Due to the changing demographics the European Commission as well as near all national funding organizations see the necessity to support assisted technologies through huge funding instruments. Despite its tremendous market potential, Ambient Assisted Living is still on the cusp of a mainstream breakthrough. A lack of viable business models is considered almost unanimously to be the greatest market obstacle to a broad implementation of innovative AAL systems [1]. The consequence has been that the European Union has invested significant resources in RTD to build open platforms, resulting in platforms such as MPOWER [2], Persona [3], and SOPRANO [4]. These platforms provided very promising results, but they were fragmented in terms of what particular needs they addressed and duplicated in terms of implementing much of the same functionality. The European Union called for a project to collect these promising results into one European open technology platform for independent living application development.

As a result, the integrated project universAAL [5] was launched in 2010. universAAL provides a free and open source software platform for developing independent living applications. The platform consists of a middleware, a set of "manager" components, and tools that facilitate its usage and configuration (cf. the universAAL developer depot [6]). universAAL establishes new market possibilities, especially for small and medium enterprises to sell their products as interoperable solutions which can be integrated with other solutions from other vendors easily in order to share data and functionality.

But, despite the great universAAL achievements, the market breakthrough of AAL is still not on the horizon. The companies are still hesitating to productize prototypes resulted from R&D. What are the reasons for this waiting position? We discussed this question in a workshop organized by AALOA [7], the AAL Association and the European Commission [8]. Almost all participants agreed that profitable business models are missing. The RoI is too low and due to the small selling numbers the prizes are too high. Therefore, the other companies see no chance for their products and the whole community circles and no progress can be seen.

Another result of this workshop has been that a common open platform could help to break the circle. Having the universAAL platform as an existing example

of such open platforms, a roll-out of this platform in large scale will be the next logical step: nobody has tried so far to compare directly the cost of application development based on interoperable semantic platforms against use-case-specific approaches with point to point connections. Consequently, a calculation of cost for AAL in large scale roll-outs could be feasible.

2 The ReAAL Mission

Following the above findings, the European Commission published a CIP-ICT-PSP call for a piloting project to show the benefit of open platforms with concrete numbers. ReAAL was the project which succeeded. The project intends to deploy a critical mass of Ambient Assisted Living applications and services for ca. 7,000 users in seven EU countries, based upon the universAAL platform, previously developed with EC support, with the intent of kick-starting the market for interoperable AAL services, applications and devices. ReAAL will facilitate the emergence of an AAL ecosystem by showing the platform usefulness, and spreading the related technical knowledge through an associated community of interest. Here, ReAAL will establish a multi-dimension evaluation methodology to measure the impact of the deployment of the AAL ecosystem in terms of the social, economic and health indicators. Such an ecosystem will, on the one-hand, allow commissioners to make investment decisions knowing that they will have support from other users of the acquired technology in an open-interoperable ecosystem, and that they will avoid vendor lock-in. On the other hand, the "standardized" platform will provide application vendors and service providers with a common basis on top of which they can invest and develop their business. This will be particularly helpful to the SMEs who are typically unable to make the sustained investments necessary to develop complete proprietary systems.

ReAAL has now the mission to try to test and to know at the end, if AAL at all could be rolled out with blanket coverage in whole Europe in the future. Therefore we need to know how much time is needed to spread the AAL applications and products in other regions when they are adapted to a common platform. On the other side it is needed to know, if the adaptation to a common platform is economically reasonable before a company wants to enter the market with a new product idea. Thus our hope is that we know at the end if interoperability is a reasonable way to follow or not.

The beneficiaries will be those people who wish to be able to avoid dependency on nursing homes, preferring to continue to live independently in their own homes. ReAAL will be realized via 14 pilots, each with a different focus. Assistance might be needed in any aspect of daily life, from health safety and security to social integration and mobility support. Other users involved in the pilots will have different needs or interests in the participation: Technology providers will validate the use of a platform as a leverage to develop more cost-efficient, innovative and mature technology. Service providers will look for a better efficiency and a better

quality perceived by their customers in the provision of the services. Policy makers will require results to analyse the Return of Investment of the public procurements. All these needs are being addressed by the set of objectives of the ReAAL project.

ReAAL will launch the usage of the universAAL open platform in real life and enable service providers to deploy interoperable services avoiding vendors-locks. Different scenarios can be foreseen: In case the service operator wants to integrate one of the actual services in place, the technology providers will use the guidelines and training material to create the bridge with the platform. After the interconnection, the service will be able to take profit of the interoperability features of the platform and provide information to other services or integrate it in a more complex value chain.

In case of a new service to be operated, the designers can create more innovative and cost effective solutions without the necessity of starting from scratch. The developers will have in mind the reuse of the technology already deployed that can be useful for their purposes. In case of the delivery of one of the native services of the platform, the procurement officers will have the guarantee that a proven technology with a large capability of extensibility and integration has been chosen.

Each service provided to end-users will be tailored to the specific needs of the target community. This will be done by the application developers and service providers. The intent is that the ReAAL ecosystem becomes self-sustaining, with developers developing applications and services either on a prospective basis, or having been commissioned to do so. Those organizations (public bodies or commercial entities) wishing to provide AAL services to end-users will either use applications in the application store of universAAL, or commission technologists to develop bespoke applications.

Current partners of universAAL participating in this project will be in the better position to exploit commercially the knowledge acquired during the creation of the platform and the experiences learned after the pilot operation. The platform is being delivered under an open source license and one of the results is the creation of the guidelines for the integration of services in the platform. In this sense, the results of the project can be adopted (and this is one of the objectives of the project) by any company interested in the participation of this growing market.

The particular services supported by this project will be operated after the deployment by the same service providers that are behind them, that is, the municipalities in Badalona, Baerum, Madrid, and Odense, the health sector association in Rotterdam called RijnmondNet, the regional authorities in Auvergne and Puglia, and the private construction project developer AJT (cf. the ReAAL consortium under www.cip-reaal.eu), with the technical support of the stakeholders/ technology providers identified during the first phase of the project. The technical responsible of the pilots should have an eye into future releases of the platform and they will be encouraged to participate in the developers communities that are supporting the platform e.g. AALOA [9], which is a community that fosters the creation and harmonization of open AHA technology platforms throughout Europe. So far, there are over 100 promoters and supporters of this community, and 5 open

projects have been started. This initiative is essential for ReAAL to mitigate the risk of relying on one single project.

ReAAL has mobilized key stakeholders from the universAAL project, including the universAAL coordinating organisation (SINTEF), the technical manager organization (UPVLC), and the runtime platform work package manager organization (Fraunhofer), which together will turn existing RTD results into tangible assets for the regions.

ReAAL will also contribute to other EU platform initiatives such as the Future Internet Public Private Partnership [10] and initiatives like fi-ware [11] that aim to advance the global competitiveness of the EU economy by introducing an innovative infrastructure for cost-effective creation and delivery of services, providing high QoS and security guarantees. It must be possible to use technology building blocks developed elsewhere in related domains so that the independent living SMEs do not fall in trap of relying on isolated technology that is incapable of being integrated into the wider realm of future technologies. This is a core part of future proofing the partner region initiatives.

3 Huge Challenges Have to be Solved

Because the domain of active and independent living is about the daily life of people who might need assistance to be able to avoid dependency on nursing homes and continue to live independently in their own homes, its scope cannot be limited to only certain applications. Assistance might be needed in any possible aspect of daily life, e.g., health, safety and security, daily activities such as personal hygiene, home cleaning, shopping and cooking, comfort and entertainment, social integration, support of mobility, reduction of costs and avoiding waste in consumption (bridge to energy efficiency), etc. This complex spectrum of possible needs and offers is referred to as the domain of Ambient Assisted Living (AAL). From an investment point of view, the AAL market should allow each individual in danger of losing independency to pick the set of applications and services over time based on the different needs that arise with ageing.

In many of the EU member and associated states, the public sector at the regional and municipal levels is increasingly willing to invest in AAL technology in order to get prepared for the socio-economic consequences of the alarming demographic change. Knowing this, technology vendors approach these bodies with the claim to have the best solution in order to benefit from the corresponding budgets and penetrate the related market. Obviously, this is a natural procedure; however, the public sector needs certain criteria that help to optimize the return of investment, for example (1) they want their technology investments to be future-proof and are looking for evidence from other regions on what is the best technology to invest in, what are the related costs, what are the effects, etc. and also they want to know the implications of choosing a specific standard, (2) they want to know the related best practice and lessons learned resulted from relevant

experiences made by other investors, (3) they want proven frameworks based on which they can evaluate certain aspects of the technology (in use) in order to make proper investment decisions. Additional they want (4) to avoid vendor lock-in; i.e., they want to put technology or parts thereof into frameworks that allow the changing of all or parts of a solution, if necessary. But not only the investors would like to avoid vendor lock-in, no single vendor can provide all the solutions needed either, as a matter of fact. Therefore, creating a single point of service for the maintenance of all deployed solutions becomes very difficult, if not impossible, when the solutions do not relate to each other in any way (i.e., are not based on same technologies and core platforms). In such a situation, maintenance costs will become a major cost factor for the investors.

On the other side, application vendors and service providers (usually regional SMEs) do have to be very cautious with their investments because the market conditions are still not very clear so that management decisions, also with regard to technological trends, can become very critical; in emerging markets, companies might become a frontrunner with just one right decision in the right time or miss the boat by just little hesitation or one wrong decision. SMEs usually agree that stable ecosystems around common open platforms will help to at least mitigate the technological risks but, as mentioned in the beginning, they are not strong enough to invest in such platforms themselves, especially (1) they are obviously concerned with maintaining the technology that is currently providing their revenue stream, and would need a very strong argument to change their technological foundations (platforms). (2) Typically, small companies that have all their resources involved in making the next releases of their products and services, have little or no capacity for research and try and error. (3) Many are sceptical to adopt technology from EU projects as there is limited evidence, low number of industry users, lack of support, etc.

The partial funding under the call was a unique opportunity for the ReAAL buyer partners to deal with these challenges in a cooperative action involving many major existing programmes and their stakeholders. The shared investment and experience within ReAAL is probably one of the few alternatives for establishing related shared knowledge portals providing best practices and replication guidelines to the investors. It will also provide the SMEs with the chance of influencing the further development of a serious candidate platform for the deployment of independent-living applications and services.

4 Relevance to EU Stakeholders and Standards

Current independent living solutions are characterized by a lack of interaction between the demand (seniors, professional and familial caregivers, insurance companies) and supply (large industry, SMEs, research) [13]. That means that services offered in the domain often fail to fit into the workflows of the domain. On the other hand, the user and demand side does not have enough knowledge of the

potential in the technological services that are available. ReAAL will overcome this shortcoming by building on the findings of the recently finished European Project BRAID [14] that consolidated the results of four European roadmap projects, to one consolidated roadmap that will ensure domain fit of the ReAAL results.

In order to support the interaction between software and devices in the independent living domain, standards are emerging. Moreover, the open platforms are creating implementations of these standards in the form of components that can be applied by SMEs and regions. universAAL, for instance, builds components that will help independent living applications to integrate with devices that support the Continua standards [15] and ZigBee support for OSGi [16] (which is a subproject of AALOA).

5 The ReAAL Objectives

With the universAAL platform as the technical basis, the ReAAL set of pilot sites will focus on eight objectives. Through achieving this set of objectives, ReAAL will effectively be contributing to the wider objectives of the European Innovation Partnership on Active and Healthy Ageing (EIP-AHA). In the following, this relevance has been highlighted for each objective separately:

5.1 7,000 Users in Seven European Countries

The first objective is to deploy at least seven applications and services in support of independent living for ca. 7,000 users in seven European countries in order to reach scales that promote the ReAAL experience as the ultimate reference for future investments. Here the relevance for EIP-AHA will be to scale-up and generate critical mass at EU level as a key for successful implementation and to help older people to stay independent and more active for longer.

5.2 Initial Portfolio of Applications

The second objective is to establish an initial portfolio of independent-living applications and services around the universAAL platform that can use the large-scale deployments as an evidence for promoting both the platform and the applications towards achieving a first market breakthrough. The application-level services deployed will comprise any existing relevant product or service that the involved pilot sites are considering for deployment, all developed independently from the universAAL platform. The corresponding applications can be migrated to

the universAAL platform or in any other form use its capabilities for achieving interoperability. This type of applications and services will demonstrate the openness of the platform and the cross-domain interoperability also with existing systems, on one side, and are the instrument for the involvement of a whole value chain consisting of local stakeholders, on the other side. Therefore, targeted market stakeholders in this case are mostly social service providers and SMEs that want to integrate their existing products and services or develop new ones using the universAAL platform resources.

Furthermore universAAL "stand-alone" AAL Applications are developed within the universAAL project that do not necessitate the involvement of entities beyond the circle of informal carers and users' own social networks. Examples are: "Agenda and reminders","Safe environment at home", "Help when outdoors", "Food and shopping management", "Medication management" and "Long Term Behaviour Analyser". Targeted users are mostly older people and their family members. And finally universAAL "enhanced" AAL Applications which are developed within the universAAL project that do necessitate a service provider in order to be operated. Examples are: "Health management", "Nutritional Advisor", "Personal safety". Targeted users are social and medical service providers, and the older people as their consumers.

As result the relevance for EIP-AHA will be to harness innovation and foster growth and expansion of EU industry; enhance deployment and take up of interoperable independent living solutions based on open standards; promote wide availability of open and flexible solutions and tools for building independent living applications and services.

5.3 Initial UniversAAL Ecosystem

A further goal is to establish the necessary circumstances for the emergence of an initial universAAL ecosystem by showing the platform usefulness and spreading the related technical knowledge. For this purpose, the ReAAL "seller" partners will set up a full exploitation environment of universAAL consisting of the uStore and Developer Depot, the runtime platform components running over native Android, Windows and Java, training courses, coaching and technical support during adaptation, and platform maintenance services. Thereby, develop a monitoring and evaluation concept for the adaptation of products and services to the universAAL platform. Here the relevance for EIP-AHA is to harness innovation and foster growth and expansion of EU industry; promote wide availability of open and flexible solutions and tools for building independent living applications and services; increase the breadth, depth and speed of the knowledge/know-how transfer and exchange of good practices across different levels.

5.4 Multi-Dimension Evaluation Methodology

At pilot, national and EU levels, establish a multi-dimension evaluation methodology to measure the impact of the deployment of the universAAL ecosystem, including indicators for the assessment of the socio-economic impact (care provision costs), the ethical and legal impacts (autonomy, dignity, privacy, compliance with laws), the market impact (ROI), the quality of life impact (active, healthy, and independent), and the user experience impact (achieved level of consistency while not restricting the type and number of the applications).

For EIP-AHA will this be relevant for developing comprehensive socio-economic evidence on impact from innovation; to provide new evidence on the return on investment of open and personalized solutions for independent living of older people supported by global standards and interoperable platforms; and for shared methodologies for evaluation and validation of innovation.

5.5 Procurement Policies, Quality Assurance and Deployment Strategies

Objective 5 will be to collect and spread a set of best practices associated with procurement policies and procedures, contract supervision and quality assurance, deployment strategies and the associated organizational aspects, as well as the related business and financing concepts. Foster knowledge sharing and pilot-to-pilot exchange of ideas, services and experiences with the organizational aspects of the delivery of services for older people. Additionally, use the uStore for service advertisement and transfer.

The relevance for EIP-AHA is to increase the breadth, depth and speed of the knowledge/know-how transfer and exchange of good practices across different levels; creating a repository of documented good practices (evidence-based) enabling easy/user friendly access and wider dissemination of available high-quality evidence in the area of active and healthy ageing (e.g. a dedicated portal); enabling mutual learning and exchange, with the use of innovative tools and social networks within European networks committed to healthy and active ageing.

5.6 Evidence of the Values of Open Platforms

Another objective is to provide evidence of the values of open platforms by explicitly organizing showcases for platform adaptability and system extensibility, cross-application resource and capability sharing, consistent user experience, shared mechanisms for localization (adaptation to cultural, ethical, and organizational context) and personalization (adaptation to the personal context) as well as shared mechanisms for system and data security.

Here the relevance for EIP-AHA will be to develop comprehensive socio-economic evidence on impact from innovation; provide new evidence on the return on investment of open and personalized solutions for independent living of older people supported by global standards and interoperable platforms.

5.7 Evidence of the Values of Open Platforms

Objective 7 is to validate the effectiveness of the value chain and derive replication guidelines for different business and organizational setups, depending on the needs per pilot site, service provider and end user category.

The relevance for EIP-AHA is to pool socio-economic evidence on return of investment and viable business models for innovation; assess potentials for return on investment in reusing of viable business models; develop and disseminate guidelines on sustainable financing and business models based on open standards.

5.8 Consolidate the Business Model of UniversAAL

The last objective is to refine and consolidate the business model of universAAL as a mandatory step for the planning of the sustainable exploitation immediately after the end of project.

Finally the relevance for EIP-AHA is to pool socio-economic evidence on return of investment and viable business models for innovation; assess potentials for return on investment in reusing of viable business models; develop and disseminate guidelines on sustainable financing and business models based on open standards.

The envisioned added value of ReAAL is twofold: (1) deliver the ultimate reference guidelines for the replication of larger deployments, and (2) pave the path for the platform sustainability and the enlargement of the universAAL ecosystem. For this reason, the further exploitation of these two concrete expected values will comprise the exploitation plan of the ReAAL partners.

The innovation promised by ReAAL is the revolutionizing of the way investors plan their approach to the deployment of active and independent living applications and services by allowing to switch from buying isolated vertical solutions to planning evolvable sets of interoperable applications according to the specific and changing needs of individuals, this way achieving the breakthrough in the domain of independent living.

As cited previously, the operational plan of EIP-AHA [10] complains about existing solutions being "largely proprietary, based on single provider design" that "cannot be easily adapted to multiple and changing users' and organizational needs". ReAAL will allay these concerns by building on interoperability standards that support the emergence of adaptable multi-vendor solutions and by delivering

the evidence of the positive socio-economic, market, and quality-of-life impacts of common open platforms that facilitate the development of affordable and flexible ICT solutions in support of an active and independent living.

6 Long Term Viability

The main outcome of the ReAAL project will be the assessment of the univers-AAL platform and architecture, as viable and cost-effective solution to create an ecosystem of services and independent living applications for an active and healthy aging. In order to provide this evidence we should, first of all, guarantee the sustainability of the platform used in all the pilot sites. This is not simple because there are many conflicting interests among all the stakeholders involved as developers or adopters of innovation: Supply side actors like SMEs prefer to have a closed proprietary solution they can market on regional area and let them slowly grow over time; Ad-hoc solutions are currently built with those "isolated" technologies, which are inevitably specific and restricted; Vertical solutions are quicker and can create a niche market but horizontal solutions can open interesting possibilities beyond the capability of vertical ones.

However, SMEs cannot assume the risk of developing a horizontal solution. In addition, these stakeholders are reluctant to adopt new solutions because they still have to capitalize their own investment already done in this emerging sector. In this situation another conflict raises among secondary and tertiary stakeholders: regional institutions that need to provide social services have to avoid technology lock-in effects in contrast to vendors of solutions that prefer the creation of niche market in which they survive by dominating with their ad hoc solution.

While this situation can be sustained by regional institutions to help the creation of an emerging local market in which SMEs couldn't survive alone, in the long term the technology lock-in effect could undermine the adoption of innovative solutions. This situation of excess inertia has been studied is comparable to the issues may occur with the standardization of a product: "there are often benefits to consumers and firms from a standardization of a product… but standardization benefits can trap industry in an obsolete or inferior standard when there is a better alternative". In fact, ad hoc solutions can be considered as "de facto" standard at regional level, because of the historical fragmentation of the health care system in all the European countries.

7 Implementation

An important challenge of ICT PSP projects is that they can hardly end up with a manageable size of their consortia. In case of ReAAL, we had to take this warning more seriously because we wanted to maximize the project impact and hence had

to balance between the number of countries, on one hand, and achieving greater impact, on the other hand.

In the early stages of building the consortium, over 20 regions from 13 different countries were willing to join the project. Based on certain criteria, such as the existence of related well-established local programmes and initiatives and the involvement and diversity of the local stakeholders within their own budgets, we finally selected 12 pilots from seven countries to be included. However, even 12 pilots with an average of 5 partners per country would exceed the objectives of consortium building in ReAAL so that we decided to try to reduce the number of partners per pilot to only 2 (one pilot leader and one accompanying technical expert) by a hierarchical management model. The idea is that ReAAL concentrates on macro-management across all pilots/nations (coordination and harmonization of project activities) in order to guarantee that the project goals can be achieved, thereby delegating micro-management at pilot/national level to the corresponding lead. This result in an abstract situation as depicted in the Fig. 1.

An advisory board consisting of representatives from IEC SG5, ETSI M2M, AGE, AALOA, European office of the Continua Health Alliance, AAL JP, the Network of European regions (CORAL), has been set up that will be invited to all of the consortium meetings. Their role should be to monitor and give advice about the achievement of the objectives from above and delivery of the exploitable results in order to make sure that the ReAAL experience becomes the ultimate reference for large-scale deployment in the domain of active and independent living.
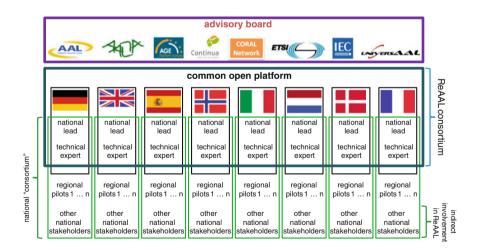

Fig. 1 Macro-management across all 12 pilots and seven nations within ReAAL

8 Next Steps

For European research projects, it is not straightforward to see all the exploitable results of the whole project as a ready to market product, but it is worth to say that universAAL was conceived as a consolidation process of older European projects that had worked in this domain for several years. Even with this claim there is no evidence of the maintenance and sustainability of the platform released by universAAL.

Moreover, ICT technologies change quickly today, and older projects need always some updating that may introduce new weakness and new attestation of the robustness has to be produced. Obviously, all this will cause costs which can be covered only if some business is formed around the technology to maintain. In case of the universAAL platform, the ReAAL project is a unique opportunity to cope with such common issues because it (1) helps the platform to reach the status of a product, (2) bespeaks its benefits, and (3) creates an initial portfolio of applications with proven benefits that can help to penetrate the market and form the needed business with the universAAL platform.

In this context, it is obvious that the actors involved in the development of the open platform face problems with the exploitation of the project results. Partners from research and academia can create coalitions with the SMEs involved in the consortium only if they can propose concrete business plans to their headquarters; this is also a necessary condition for the creation of innovative start up or spin off companies.

And now that universAAL will have its final release during 2013, the AAL community, especially those who signed the Lecce Declaration [17], should be curious in ReAAL outcome. This will put a lot of pressure on this project, but we hope that it will pave the long desired outcome and face the long, rocky road to reach the enthusiastic goal of overcoming the market entrance barriers and achieve the market breakthrough in AAL.

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